CLAIMS

1. An optical fibre with a waveguide structure having a longitudinal direction, said optical fibre having:

- a core region extending along the longitudinal direction,

- a cladding region extending along the longitudinal direction, said cladding region comprising an at least substantially two-dimensionally periodic structure comprising primary, elongated elements each having a centre axis extending in the longitudinal direction of the waveguide, the primary elements having a refractive index being lower than a refractive index of any material adjacent to the primary elements,

the periodic structure being, in a cross-section perpendicular to the longitudinal direction, defined by at least one unit cell, wherein, for each unit cell:

- a first circle is defined as the largest circular area possible having a centre not positioned outside the unit cell and not enclosing any part of any primary elements, and
- one or more further elongated elements are provided each of which
  - has an area not exceeding 1/6 of the area of that primary element having its centre within the unit cell and having the largest area,
  - has a refractive index being lower than that of any material adjacent thereto,
  - has a centre not positioned outside the unit cell, and
  - does not cover the centre of the first circle.

2. An optical fibre according to claim 1, wherein the one or more further elements each has an area not exceeding 1/8, the area of that primary element having its centre within the unit cell and having the largest area.

3. An optical fibre according to claim 1, wherein, for the unit cell, a second circle is defined being the largest possible circle having its centre not positioned outside the unit cell, and where the second circle not comprising any parts of the first or further elongated elements, and where the area of the second circle is smaller than that of the first circle.

4. An optical fibre according to claim 3, wherein the area of the second circle is 90% or less than that of the first circle.

5. An optical fibre according to claim 3, the centre of first circle at least substantially coincides with the centre of the second circle.

6. An optical fibre according to claim 1, wherein the centres of those primary elements, parts of which are within a distance of 1.5 or less times the radius of the first circle from the centre of the first circle, define the vertices of a polygon with three or more sides.

7. An optical fibre according to claim 6, wherein the polygon is a regular polygon.

8. An optical fibre according to claim 6, wherein the polygon is chosen from the group consisting of a triangular, rectangular, quadratic, or hexagonal polygon.

9. An optical fibre with a waveguide structure having a longitudinal direction, said optical fibre having:

- a core region extending along the longitudinal direction,

- a cladding region extending along the longitudinal direction, said cladding region comprising an at least substantially two-dimensionally periodic structure comprising primary, elongated elements each having a centre axis extending in the longitudinal direction of the waveguide, the primary elements having a refractive index being lower than a refractive index of any material adjacent to the elongated elements,

the periodic structure being defined, in a cross-section perpendicular to the longitudinal direction, by a unit cell, where the sum of all areas of elongated elements, which areas are comprised within the unit cell, is larger than 1.2 times the area of that primary element having its centre axis not positioned outside the unit cell and having the largest area.

10. An optical fibre according to claim 9, wherein the sum of all areas of elongated elements comprised within the unit cell is larger than 1.3 times the area of that primary element having its centre axis not positioned outside the unit cell and having the largest area.

11. An optical fibre according to claim 9, wherein the periodic structure comprises secondary elongated elements having a refractive index being larger than that of any material adjacent thereto and to any material being adjacent to a primary element.

12. An optical fibre according to claim 11, wherein, for a unit cell, the sum of all areas of secondary elements within the unit cell is larger than 0.25 times the area of a secondary element having its centre axis not positioned outside the unit cell and having the largest area.

13. An optical fibre according to claim 11, wherein, for a unit cell, the sum of all areas of secondary elements within the unit cell is larger than 0.05 times the area of the primary element having its centre axis not positioned outside the unit cell and having the largest area.

14. An optical fibre with a waveguide structure having a longitudinal direction, said optical fibre having:

- a core region extending along the longitudinal direction,

- a cladding region extending along the longitudinal direction, said cladding region comprising an at least substantially two-dimensionally periodic structure comprising primary, elongated elements each having a centre axis extending in the longitudinal direction of the waveguide, the primary elements having a refractive index being lower than a refractive index of any material adjacent to the primary elements,

the periodic structure being, in a cross-section perpendicular to the longitudinal direction, defined by a unit cell, and where a polygon is defined:

- having centres of primary elements in its vertices,
- not enclosing any centres of other primary elements than those having their centres at the vertices of the polygon, and
- having an area less than or equal to that of the unit cell,

where a first circle is defined as the smallest circle possible having its centre positioned within the polygon, and which comprises the vertices of the polygon,

and where the area of the circle divided by the area of the polygon is less than 2.4.

15. An optical fibre according to claim 14, wherein the polygon is a regular polygon and the first circle is that circumscribing the polygon.

16. An optical fibre according to claim 14, wherein the polygon has four or more sides.

17. An optical fibre according to claim 16, wherein the polygon is quadratic or a hexagonal polygon.

18. An optical fibre with a waveguide structure having a longitudinal direction, said optical fibre having:

- a core region extending along the longitudinal direction,

- a cladding region extending along the longitudinal direction, said cladding region comprising an at least substantially two-dimensionally periodic structure comprising primary, elongated elements each having a centre axis extending in the longitudinal direction of the waveguide, the primary elements having a refractive index being lower than a refractive index of any material adjacent to the primary elements,

the periodic structure being, in a cross-section perpendicular to the longitudinal direction, defined by a unit cell, where, in each unit cell:

$$n_d \Lambda_2 > n_{ud} \Lambda_1(\sqrt{3})$$

where

- n_d is the largest index of refraction within a first circle which is defined as a largest circle possible having a centre not positioned outside the unit cell and not enclosing any part of any primary element,
- n_{ud} is a largest index of refraction not positioned outside the unit cell but outside any of the first circles of the unit cells,
- Λ_1 is a smallest distance between centre axes of two primary elements within the periodic structure,

- Λ_2 is a distance between the centre of the first circle of the unit cell and the centre of the first circle of an adjacent unit cell.

19. An optical fibre according to claim 18, wherein, for each unit cell: $n_d \Lambda_2 > 2 n_{ud} \Lambda_1$.

20. An optical fibre according to claim 18, wherein, in each unit cell, n_d is at least substantially identical to n_{ud}.

21. An optical fibre according to claim 18, wherein, in each unit cell, $n_d > n_{ud}$.

22. An optical fibre according to claim 18, wherein n_{ud} is and n_d is selected within the interval of 1-10.

23. An optical fibre according to claim 18, wherein the unit cell comprises further elongated elements each having a centre axis extending in the longitudinal direction of the waveguide, the cross-sectional area of each of the further elements being less than 1/6 of a cross-sectional area of that primary element, having its centre within the unit cell, having the largest cross-sectional area.

24. An optical fibre according to claim 23, wherein:

$$n_d \Lambda_2 > (\sqrt{3})\, n_{ud} \Lambda_3$$

where

- n_d is the largest index of refraction within a first circle which is defined as a largest circle possible having a centre not positioned outside the unit cell and not enclosing any part of any primary element,
- n_{ud} is a largest index of refraction not positioned outside the unit cell but outside any of the first circles of the unit cells,
- Λ_3 is a smallest distance between centre axes of two primary or further elements within the periodic structure,
- Λ_2 is a smallest distance between the centres of two adjacent first circles.

25. An optical fibre according to claim 24, wherein, for each unit cell: $n_d \Lambda_2 > 2 n_{ud} \Lambda_3$.

26. An optical fibre with a waveguide structure having a longitudinal direction, said optical fibre having:

- a core region extending along the longitudinal direction,

- a cladding region extending along the longitudinal direction, said cladding region comprising an at least substantially two-dimensionally periodic structure comprising primary, elongated elements each having a centre axis extending in the longitudinal direction of the waveguide, the primary elements having a refractive index being lower than a refractive index of any material adjacent to the primary elements,

the periodic structure being, in a cross-section perpendicular to the longitudinal direction, defined by at least one unit cell, where, for each unit cell, a first circle is defined as the largest circular area possible having a centre not positioned outside the unit cell and not enclosing any part of any primary elements,

where more than 3 first primary elements exist, parts of which exist within a distance of 1.2 or less times the radius of the first circle from the centre of the first circle.

27. An optical fibre according to claim 26, wherein more than 4 first primary elements exist, parts of which exist within a distance of 1.2 or less times the radius of the first circle from the centre of the first circle.

28. An optical fibre according to claim 26, wherein the parts of the first primary elements exist within a distance of 1.1 or less times the radius of the first circle from the centre of the first circle.

29. An optical fibre according to claim 26, wherein the first primary elements define a polygon having 3-6 sides and having centres of first primary elements in its vertices, each of the first primary elements not having centres in the vertices being positioned with its centre axis no further from a side of the polygon than 1/5 of a length of that side.

30. An optical fibre with a waveguide structure having a longitudinal direction, said optical fibre having:

- a core region extending along the longitudinal direction,

- a cladding region extending along the longitudinal direction, said cladding region comprising an at least substantially two-dimensionally periodic structure comprising primary, elongated elements each having a centre axis extending in the longitudinal direction of the waveguide, each primary element having a refractive index being lower than a refractive index of any material adjacent to the primary element,

the periodic structure being, in a cross-section perpendicular to the longitudinal direction, defined by a unit cell, and where, for each unit cell, one or more polygons are defined as:

- a first polygon is defined as having its vertices at centres of first primary elements selected by:
  - defining a first circle as the largest circular area possible having a centre not positioned outside the unit cell and not enclosing any part of any primary elements,
  - selecting the first primary elements as those having not positioned further away from the centre of the first circle than 1.2 times the radius of the first circle,
- for each area, if any, of the unit cell, which area is not comprised within a first polygon, an additional polygon is defined as having its vertices at centres of additional primary elements selected by:
  - defining an additional circle as the largest circular area possible having a centre not positioned outside the area and not enclosing any part of any primary elements,
  - selecting the additional primary elements as those having their centres not positioned further away from the centre of the additional circle than 1.2 times the radius of the additional circle.

the periodic structure comprising deviating primary elements having a shape deviating from a circular shape and having extending parts defined as those parts of the shape of the deviating primary element extending outside a circle having the same area as that of the deviating primary element and having its centre at a centre of the deviating primary element, each extending part extending toward one of those primary elements which together with which the deviating primary element defines a side of a polygon in the periodic structure,

each extending part extending toward a primary element and having an area being larger than 3% of the area of the circle.

31. An optical fibre according to claim 30, wherein at least one extending part has an axis of symmetry at least substantially coinciding with a line intersecting the centre of the circle and the centre of a primary element with which the deviating primary element defines a side.

32 An optical fibre according to claim 30, wherein at least one extending part extends a distance of at least 5% of the radius of the circle and in a direction away from the centre of the circle.

33. An optical fibre according to claim 30, wherein a first circle is defined as the smallest possible circle having its centre positioned within the first polygon, and which comprises (meaning: within or on the boundary) the vertices of the first polygon.

34. An optical fibre according to claim 30, wherein the first polygon has four or more sides.

35. An optical fibre according to claim 34, wherein the first polygon is a hexagonal.

36 An optical fibre according to claim 30, wherein the first polygon is regular.

37. An optical fibre with a waveguide structure having a longitudinal direction, said optical fibre having:

- a core region extending along the longitudinal direction,

- a cladding region extending along the longitudinal direction, said cladding region comprising an at least substantially two-dimensionally periodic structure comprising primary, elongated elements each having a centre axis extending in the longitudinal direction of the waveguide, the primary elements each having a refractive index being lower than a refractive index of any material adjacent to the primary element,

the periodic structure being, in a cross-section perpendicular to the longitudinal direction, defined by a unit cell, and where a polygon is defined:

- having centres of primary elements in its vertices,
- not enclosing any centres of other primary elements than those having their centres at the vertices of the polygon, and
- having an area less than or equal to that of the unit cell,

the polygon being a regular, hexagonal polygon.

38. An optical fibre according to claim 37, wherein one or more further elongated elements are provided each of which

- has an area not exceeding 1/6 of the area of that primary element having its centre within the unit cell and having the largest area,
- has a refractive index being lower than that of any material adjacent thereto,

where:

- further elements of two polygons sharing a common side are positioned symmetrically around a centre of the common side, and
- further elements of two polygons sharing a single primary element are positioned symmetrically around a centre of the single primary element.

39. An optical fibre according to claim 38, wherein the one or more further elongated elements each has an area not exceeding 1/8 of the area of that primary element having its centre within the unit cell and having the largest area.

40. An optical fibre according to claim 37, wherein, in the periodic structure, regular hexagonal polygons exist, all sides of which are shared with another regular hexagonal polygon.

41. An optical fibre according to claim 37, wherein the structure is defined by the regular hexagonal polygon and a regular triangle having a side length corresponding to that of the regular hexagonal polygon, and where hexagonal polygons exist, each side of which is shared with a triangle.

42. An optical fibre according to claim 1, wherein the periodic structure further comprises one or more secondary elongated elements having a refractive index higher than that of

any material adjacent thereto or adjacent to any primary elements, the secondary elements each has a centre axis extending in the longitudinal direction of the fibre.

43. An optical fibre according to claim 42, wherein, in each unit cell, a secondary element is provided having its centre axis within the first circle.

44. An optical fibre according to claim 14, wherein the periodic structure further comprises one or more secondary elongated elements having a refractive index higher than that of any material adjacent thereto or adjacent to any primary elements, the secondary elements each has a centre axis extending in the longitudinal direction of the fibre.

45. An optical fibre according to claim 44, wherein, in each unit cell, a secondary element is provided having its centre axis within the first circle.

46. An optical fibre according to claim 18, wherein the periodic structure further comprises one or more secondary elongated elements having a refractive index higher than that of any material adjacent thereto or adjacent to any primary elements, the secondary elements each has a centre axis extending in the longitudinal direction of the fibre.

47. An optical fibre according to claim 46, wherein, in each unit cell, a secondary element is provided having its centre axis within the first circle.

48. An optical fibre according to claim 26, wherein the periodic structure further comprises one or more secondary elongated elements having a refractive index higher than that of any material adjacent thereto or adjacent to any primary elements, the secondary elements each has a centre axis extending in the longitudinal direction of the fibre.

49. An optical fibre according to claim 48, wherein, in each unit cell, a secondary element is provided having its centre axis within the first circle.

50. An optical fibre according to claim 33, wherein the periodic structure further comprises one or more secondary elongated elements having a refractive index higher than that of any material adjacent thereto or adjacent to any primary elements, the secondary elements each has a centre axis extending in the longitudinal direction of the fibre.

51. An optical fibre according to claim 50, wherein, in each unit cell, a secondary element is provided having its centre axis within the first circle.

52. An optical fibre according to claim 37, wherein the periodic structure further comprises one or more secondary elongated elements having a refractive index higher than that of any material adjacent thereto or adjacent to any primary elements, the secondary elements each has a centre axis extending in the longitudinal direction of the fibre.

53. An optical fibre according to claim 52, wherein, in each unit cell, a secondary element is provided having its centre axis within the first circle.

54. An optical fibre with a waveguide structure having a longitudinal direction, said optical fibre having:

- a core region extending along the longitudinal direction,

- a cladding region extending along the longitudinal direction, said cladding region comprising an at least substantially two-dimensionally periodic structure comprising primary, elongated elements each having a centre axis extending in the longitudinal direction of the waveguide, the primary elements each having a refractive index being lower than a refractive index of any material adjacent to the primary element,

the periodic structure further comprising secondary, elongated elements each having a refractive index being larger than that of any material adjacent thereto and any material adjacent to a primary element, each secondary element having a centre axis extending in the longitudinal direction of the fibre.

55. An optical fibre according to claim 54, wherein the periodic structure is, in a cross-section perpendicular to the longitudinal direction, defined by at least one unit cell, where, for each unit cell, a first circle is defined as the largest circular area possible having a centre not positioned outside the unit cell and not enclosing any part of any primary elements, where a secondary element is provided having its centre axis within the first circle.

56. An optical fibre according to claim 55, wherein a plurality of first primary elements exist, parts of which exist within a distance of 1.2 or less times the radius of the first circle from the centre of the first circle, a polygon being defined as having its vertices at the centres of the plurality of first primary elements, the polygon being a regular, hexagonal polygon.

57. An optical fibre according to claim 56, wherein, in the periodic structure, hexagonal polygons exist, all sides of which are common to another hexagonal polygon.

58. An optical fibre according to claim 56, wherein the structure is defined by the hexagonal polygon and a regular triangle having a side length corresponding to that of the regular hexagonal polygon, and where hexagonal polygons exist, each side of which is common to a triangle.

59. An optical fibre according to claim 1, wherein the core region comprises a first additional elongated element extending in the longitudinal direction of the fibre.

60. An optical fibre according to claim 59, wherein the first additional element is a void.

61. An optical fibre according to claim 59, wherein the additional element or any material adjacent thereto comprises a dopant or a material showing higher order optical effects.

62. An optical fibre according to claim 59, wherein the core region comprises a second additional elongated element, the first and second additional elements being positioned at a distance where light travelling in one additional element is able to couple to the other additional element.

63. An optical fibre according to claim 14, wherein the core region comprises a first additional elongated element extending in the longitudinal direction of the fibre.

64. An optical fibre according to claim 63, wherein the first additional element is a void.

65. An optical fibre according to claim 63, wherein the additional element or any material adjacent thereto comprises a dopant or a material showing higher order optical effects.

66. An optical fibre according to claim 63, wherein the core region comprises a second additional elongated element, the first and second additional elements being positioned at a distance where light travelling in one additional element is able to couple to the other additional element.

67. An optical fibre according to claim 18, wherein the core region comprises a first additional elongated element extending in the longitudinal direction of the fibre.

68. An optical fibre according to claim 67, wherein the first additional element is a void.

69. An optical fibre according to claim 67, wherein the additional element or any material adjacent thereto comprises a dopant or a material showing higher order optical effects.

70. An optical fibre according to claim 67, wherein the core region comprises a second aditional elongated element, the first and second additional elements being positioned at a distance where light travelling in one additional element is able to couple to the other additional element.

71. An optical fibre according to claim 26, wherein the core region comprises a first additional elongated element extending in the longitudinal direction of the fibre.

72. An optical fibre according to claim 71, wherein the first additional element is a void.

73. An optical fibre according to claim 71, wherein the additional element or any material adjacent thereto comprises a dopant or a material showing higher order optical effects.

74. An optical fibre according to claim 71, wherein the core region comprises a second additional elongated element, the first and second additional elements being positioned at a distance where light travelling in one additional element is able to couple to the other additional element.

75. An optical fibre according to claim 33, wherein the core region comprises a first additional elongated element extending in the longitudinal direction of the fibre.

76. An optical fibre according to claim 75, wherein the first additional element is a void.

77. An optical fibre according to claim 75, wherein the additional element or any material adjacent thereto comprises a dopant or a material showing higher order optical effects.

78. An optical fibre according to claim 75, wherein the core region comprises a second additional elongated element, the first and second additional elements being positioned at a distance where light travelling in one additional element is able to couple to the other additional element.

79. An optical fibre according to claim 37, wherein the core region comprises a first additional elongated element extending in the longitudinal direction of the fibre.

80. An optical fibre according to claim 79, wherein the first additional element is a void.

81. An optical fibre according to claim 79, wherein the additional element or any material adjacent thereto comprises a dopant or a material showing higher order optical effects.

82. An optical fibre according to claim 79, wherein the core region comprises a second additional elongated element, the first and second additional elements being positioned at a distance where light travelling in one additional element is able to couple to the other additional element.

83. An optical fibre according to claim 44, wherein the core region comprises a first additional elongated element extending in the longitudinal direction of the fibre.

84. An optical fibre according to claim 83, wherein the first additional element is a void.

85. An optical fibre according to claim 83, wherein the additional element or any material adjacent thereto comprises a dopant or a material showing higher order optical effects.

86. An optical fibre according to claim 83, wherein the core region comprises a second additional elongated element, the first and second additional elements being positioned at a distance where light travelling in one additional element is able to couple to the other additional element.

87. An optical fibre according to claim 1 the fibre comprising a plurality of core regions.

88. An optical fibre according to claim 87, wherein the core regions are positioned symmetrically within the periodical structure, a period of the core regions being larger than a period of the periodical structure.

89. An optical fibre according to claim 14, the fibre comprising a plurality of core regions.

90. An optical fibre according to claim 89, wherein the core regions are positioned symmetrically within the periodical structure, a period of the core regions being larger than a period of the periodical structure.

91. An optical fibre according to claim 18, the fibre comprising a plurality of core regions.

92. An optical fibre according to claim 91, wherein the core regions are positioned symmetrically within the periodical structure, a period of the core regions being larger than a period of the periodical structure.

93. An optical fibre according to claim 26, the fibre comprising a plurality of core regions.

94. An optical fibre according to claim 93, wherein the core regions are positioned symmetrically within the periodical structure, a period of the core regions being larger than a period of the periodical structure.

95. An optical fibre according to claim 33, the fibre comprising a plurality of core regions.

96. An optical fibre according to claim 95, wherein the core regions are positioned symmetrically within the periodical structure, a period of the core regions being larger than a period of the periodical structure.

97. An optical fibre according to claim 37, the fibre comprising a plurality of core regions.

98. An optical fibre according to claim 97, wherein the core regions are positioned symmetrically within the periodical structure, a period of the core regions being larger than a period of the periodical structure.

99. An optical fibre according to claim 44, the fibre comprising a plurality of core regions.

100. An optical fibre according to claim 99, wherein the core regions are positioned symmetrically within the periodical structure, a period of the core regions being larger than a period of the periodical structure.

101. A sensor for sensing or detecting at least one characteristic of a liquid or gas, the sensor comprising:

- a length of the optical fibre according to claim 1, wherein the core region comprises at least a first additional element, the first element being a void extending along the longitudinal direction of the fibre,
- means for providing the liquid or gas into the void of the core region,
- means for introducing light into the core region, the light being adapted to interact with the gas or liquid in a manner so that the characteristic of the liquid or gas may be determined,
- means for detecting light emitted from the fibre and for determining the characteristic of the liquid or gas.

102. A sensor according to claim 101, wherein the introducing means are adapted to introduce the light into the first additional element.

103. A sensor according to claim 101, wherein the core region comprises a second, elongated element extending in the longitudinal direction of the fibre, where the first and second additional elements are positioned at a distance where light travelling in one additional element is able to couple to the other additional element, and wherein the introducing means are adapted to introduce the light into the second additional element.

104. A sensor for sensing or detecting at least one characteristic of a liquid or gas, the sensor comprising:

- a length of the optical fibre according to claim 14, wherein the core region comprises at least a first additional element, the first element being a void extending along the longitudinal direction of the fibre,

- means for providing the liquid or gas into the void of the core region,
- means for introducing light into the core region, the light being adapted to interact with the gas or liquid in a manner so that the characteristic of the liquid or gas may be determined,
- means for detecting light emitted from the fibre and for determining the characteristic of the liquid or gas.

105. A sensor according to claim 104, wherein the introducing means are adapted to introduce the light into the first additional element.

106. A sensor according to claim 104, wherein the core region comprises a second, elongated element extending in the longitudinal direction of the fibre, where the first and second additional elements are positioned at a distance where light travelling in one additional element is able to couple to the other additional element, and wherein the introducing means are adapted to introduce the light into the second additional element.

107. A sensor for sensing or detecting at least one characteristic of a liquid or gas, the sensor comprising:

- a length of the optical fibre according to claim 18, wherein the core region comprises at least a first additional element, the first element being a void extending along the longitudinal direction of the fibre,
- means for providing the liquid or gas into the void of the core region,
- means for introducing light into the core region, the light being adapted to interact with the gas or liquid in a manner so that the characteristic of the liquid or gas may be determined,
- means for detecting light emitted from the fibre and for determining the characteristic of the liquid or gas.

108. A sensor according to claim 107, wherein the introducing means are adapted to introduce the light into the first additional element.

109. A sensor according to claim 107, wherein the core region comprises a second, elongated element extending in the longitudinal direction of the fibre, where the first and second additional elements are positioned at a distance where light travelling in one

additional element is able to couple to the other additional element, and wherein the introducing means are adapted to introduce the light into the second additional element.

110. A sensor for sensing or detecting at least one characteristic of a liquid or gas, the sensor comprising:

- a length of the optical fibre according to claim 26, wherein the core region comprises at least a first additional element, the first element being a void extending along the longitudinal direction of the fibre,
- means for providing the liquid or gas into the void of the core region,
- means for introducing light into the core region, the light being adapted to interact with the gas or liquid in a manner so that the characteristic of the liquid or gas may be determined,
- means for detecting light emitted from the fibre and for determining the characteristic of the liquid or gas.

111. A sensor according to claim 110, wherein the introducing means are adapted to introduce the light into the first additional element.

112. A sensor according to claim 110, wherein the core region comprises a second, elongated element extending in the longitudinal direction of the fibre, where the first and second additional elements are positioned at a distance where light travelling in one additional element is able to couple to the other additional element, and wherein the introducing means are adapted to introduce the light into the second additional element.

113. A sensor for sensing or detecting at least one characteristic of a liquid or gas, the sensor comprising:

- a length of the optical fibre according to claim 33, wherein the core region comprises at least a first additional element, the first element being a void extending along the longitudinal direction of the fibre,
- means for providing the liquid or gas into the void of the core region,
- means for introducing light into the core region, the light being adapted to interact with the gas or liquid in a manner so that the characteristic of the liquid or gas may be determined,

- means for detecting light emitted from the fibre and for determining the characteristic of the liquid or gas.

114. A sensor according to claim 113, wherein the introducing means are adapted to introduce the light into the first additional element.

115. A sensor according to claim 113, wherein the core region comprises a second, elongated element extending in the longitudinal direction of the fibre, where the first and second additional elements are positioned at a distance where light travelling in one additional element is able to couple to the other additional element, and wherein the introducing means are adapted to introduce the light into the second additional element.

116. A sensor for sensing or detecting at least one characteristic of a liquid or gas, the sensor comprising:

- a length of the optical fibre according to claim 37, wherein the core region comprises at least a first additional element, the first element being a void extending along the longitudinal direction of the fibre,
- means for providing the liquid or gas into the void of the core region,
- means for introducing light into the core region, the light being adapted to interact with the gas or liquid in a manner so that the characteristic of the liquid or gas may be determined,
- means for detecting light emitted from the fibre and for determining the characteristic of the liquid or gas.

117. A sensor according to claim 116, wherein the introducing means are adapted to introduce the light into the first additional element.

118. A sensor according to claim 116, wherein the core region comprises a second, elongated element extending in the longitudinal direction of the fibre, where the first and second additional elements are positioned at a distance where light travelling in one additional element is able to couple to the other additional element, and wherein the introducing means are adapted to introduce the light into the second additional element.

119. A sensor for sensing or detecting at least one characteristic of a liquid or gas, the sensor comprising:

- a length of the optical fibre according to claim 44, wherein the core region comprises at least a first additional element, the first element being a void extending along the longitudinal direction of the fibre,
- means for providing the liquid or gas into the void of the core region,
- means for introducing light into the core region, the light being adapted to interact with the gas or liquid in a manner so that the characteristic of the liquid or gas may be determined,
- means for detecting light emitted from the fibre and for determining the characteristic of the liquid or gas.

120. A sensor according to claim 119, wherein the introducing means are adapted to introduce the light into the first additional element.

121. A sensor according to claim 119, wherein the core region comprises a second, elongated element extending in the longitudinal direction of the fibre, where the first and second additional elements are positioned at a distance where light travelling in one additional element is able to couple to the other additional element, and wherein the introducing means are adapted to introduce the light into the second additional element.

122. A fibre amplifier for amplifying an optical signal, said fibre amplifier comprising:

- a length of optical fibre according to 1, wherein the core region comprises a dopant material along at least part of the length, and

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal.

123. A fibre amplifier for amplifying an optical signal, said fibre amplifier comprising:

- a length of optical fibre according to claim 14, wherein the core region comprises a dopant material along at least part of the length, and

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal.

124. A fibre amplifier for amplifying an optical signal, said fibre amplifier comprising:

- a length of optical fibre according to claim 18, wherein the core region comprises a dopant material along at least part of the length, and

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal.

125. A fibre amplifier for amplifying an optical signal, said fibre amplifier comprising:

- a length of optical fibre according to claim 26, wherein the core region comprises a dopant material along at least part of the length, and

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal.

126. A fibre amplifier for amplifying an optical signal, said fibre amplifier comprising:

- a length of optical fibre according to claim 33, wherein the core region comprises a dopant material along at least part of the length, and

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal.

127. A fibre amplifier for amplifying an optical signal, said fibre amplifier comprising:

- a length of optical fibre according to claim 37, wherein the core region comprises a dopant material along at least part of the length, and

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal.

128. A fibre amplifier for amplifying an optical signal, said fibre amplifier comprising:

- a length of optical fibre according to claim 44, wherein the core region comprises a dopant material along at least part of the length, and

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal.

129. A fibre laser for outputting laser radiation, said fibre laser comprising:

- a length of optical fibre according to claim 1, wherein the core region comprises a dopant material along at least part of the length,

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal, and

- feedback means for selectively feeding back at least part of the amplified optical signal so as to repeatedly pass the amplified optical signal through the length of the optical fibre so as to further amplify the optical signal.

130. A fibre laser for outputting laser radiation, said fibre laser comprising:

- a length of optical fibre according to claim 14, wherein the core region comprises a dopant material along at least part of the length,

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal, and

- feedback means for selectively feeding back at least part of the amplified optical signal so as to repeatedly pass the amplified optical signal through the length of the optical fibre so as to further amplify the optical signal.

131. A fibre laser for outputting laser radiation, said fibre laser comprising:

- a length of optical fibre according to claim 18, wherein the core region comprises a dopant material along at least part of the length,

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal, and

- feedback means for selectively feeding back at least part of the amplified optical signal so as to repeatedly pass the amplified optical signal through the length of the optical fibre so as to further amplify the optical signal.

132. A fibre laser for outputting laser radiation, said fibre laser comprising:

- a length of optical fibre according to claim 26, wherein the core region comprises a dopant material along at least part of the length,

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal, and

- feedback means for selectively feeding back at least part of the amplified optical signal so as to repeatedly pass the amplified optical signal through the length of the optical fibre so as to further amplify the optical signal.

133. A fibre laser for outputting laser radiation, said fibre laser comprising:

- a length of optical fibre according to claim 33, wherein the core region comprises a dopant material along at least part of the length,

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal, and

- feedback means for selectively feeding back at least part of the amplified optical signal so as to repeatedly pass the amplified optical signal through the length of the optical fibre so as to further amplify the optical signal.

134. A fibre laser for outputting laser radiation, said fibre laser comprising:

- a length of optical fibre according to claim 37, wherein the core region comprises a dopant material along at least part of the length,

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal, and

- feedback means for selectively feeding back at least part of the amplified optical signal so as to repeatedly pass the amplified optical signal through the length of the optical fibre so as to further amplify the optical signal.

135. A fibre laser for outputting laser radiation, said fibre laser comprising:

- a length of optical fibre according to claim 44, wherein the core region comprises a dopant material along at least part of the length,

- means for providing pump radiation to the dopant material for pumping the dopant material so as to amplify the optical signal, and

- feedback means for selectively feeding back at least part of the amplified optical signal so as to repeatedly pass the amplified optical signal through the length of the optical fibre so as to further amplify the optical signal.